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10/070085
JC19 Rec'd PCT/PTO 04 MAR 2002

ELECTRIC PRECISION INJECTION UNIT

Description

The invention is directed to a precision injection unit for a machine for producing molded articles with a drive device for the rotation of the worm and a drive device for the axial movement of the worm.

DE 42 06 966 discloses an injection unit with only one drive motor for the axial and radial movement of the worm. The rotating movement of the worm is carried out by the motor via a belt drive, one belt drive being connected with the worm shaft by a splined shaft section in a positive engagement, but so as to be axially displaceable.

The rear part of the worm shaft is constructed as a ball spindle and engages with the corresponding spindle nut. The ball spindle nut is supported in the frame so as to be rotatable and can be secured by a claw coupling relative to the frame. A spring element constantly presses the ball spindle with the spindle nut axially against the frame.

During the plastifying process for plastic, the coupling is not engaged. During the injection process, the coupling is activated, so that the worm is compelled to move axially when the motor rotates. Only a very slight small axial lift or stroke is achieved in this construction.

Further, it must be viewed as a disadvantage that the worm rotation and the axial position can not be influenced independent from one another.

EP 0 427 866 describes an injection unit with a metering motor and an injection motor which is constructed as a dual-platen injection unit. The injection unit has a fixed platen in which two ball spindles are secured axially and a movable platen with two linear guides which are connected with one another via the ball spindles and associated ball spindle nuts. The metering motor is fastened to the movable platen and drives the worm (in rotation) via a belt drive.

The injection motor is fastened to the fixed platen and drives the two ball spindles via a belt drive for the axial injection movement of the movable platen.

The described injection unit has a complicated mechanical

construction and, accordingly, a great many movable elements which results in increased maintenance and wear. Since the injection motor must move very massive parts of the injection unit, the mass moment of inertia is also high and accordingly limits effectiveness and efficiency.

SUMMARY OF THE INVENTION

Proceeding from the problems and disadvantages described above, the object of the invention is to provide an above-average, economically operating and reliable precision injection unit using features which are known in part.

An extremely compact construction of the drive block of the injection unit which is limited to a minimum of parts is achieved by integrating two drive devices for axial movement and worm rotation, wherein it is possible to achieve a temporary flow of force. High efficiency and high availability are achieved in this way.

A drive shaft with a cylindrical connection for the worm coupling is mounted so as to be freely rotatable at the other end along with a splined shaft section in a screw sleeve with two axial load-bearing capability rolling bearings. The splined shaft section of the shaft engages with a complementary axial splined shaft coupling which is connected, via a gear unit, to the servo motor for the rotating movement of the worm.

The screw sleeve, preferably a planetary roll spindle, engages with a complementary spindle nut. The spindle nut is freely rotatable in the housing of the drive block of the injection unit with two axial load-bearing rolling bearings. A servo motor drives the spindle nut by means of a belt drive and, depending on the rotating direction, the screw sleeve and, therefore, also the plastifying worm moves axially in one or the other direction, since the screw sleeve operates as a means for preventing rotation which is guided in a housing groove and therefore prevents the screw sleeve from participating in rotation.

The axial movement (injection/metering or influencing of the pressure profile of the melt) and the rotation of the worm (plastifying) can be carried out completely independent from one another.

The shortest possible flow of force with the smallest mass moment of inertia combined with high efficiency and low maintenance is achieved by means of this construction.

Only the selected construction length of the screw sleeve, and the length of the splined shaft profile coupling which is adapted to it, limits (a drive block) the possible injection stroke of the worm.

An embodiment example of the invention is shown in the drawings and described in the following.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a simplified view of the drive block of the injection unit;

Fig. 2 shows a practical construction;

Fig. 3 shows a section along line A-A.

The shaft 1 has a cylindrical part for the connection of the worm coupling, not shown, at one end and a splined shaft profile at the other end. The shaft 1 is supported in the screw sleeve 8 by the shaft bearings 2 and can rotate independent from it. The radial forces and the high axial forces occurring particularly during injection are conducted into the screw sleeve 8 by the shaft bearings 2.

The axial splined shaft coupling 3 engages with the splined shaft profile of the shaft 1. The axial splined shaft coupling 3 is fixedly connected with the drive shaft of the gear unit 4 which is screwed to the housing 11. The torque of the motor 7 which is also fastened to the housing 11 is transmitted to the gear unit 4 via the belt drives 5 and 6.

The spindle nut 9 engages with the screw sleeve 8 and is supported in the housing 11 by the spindle nut bearing 10 so as to be rotatable. The high axial forces occurring during the injection are conducted into the housing 11 via the spindle nut bearing 10.

The spindle nut 9 has a flange to which the belt drives 13 and 14 are flanged and the torque can accordingly be transmitted from the gear unit motor 15 fastened to the housing 11 and from the belt drive.

The screw sleeve 8 has a screw sleeve rotation-preventing means 12 which is guided in axial direction in a groove-shaped part of the housing 11 and

prevents the screw sleeve 8 from rotating along during rotation of the spindle nut 9 and shaft 1.

When the spindle nut 9 is set in rotation, the screw sleeve 8 must compulsorily move with the shaft 1 in axial direction.

A pressure sensor is provided at a bearing loaded by axial force for direct instantaneous measurement of axial force.

The arrangement and construction of the drive devices and belt drives are shown particularly in the practical construction shown in Figures 2 and 3.